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U. S. NAVY EDUCATION STUDY COURSES

MANUAL OF STANDARD PRACTICE AND ANNOUNCEMENT OF COURSES

REVISED MARCH, 1922

NAVY DEPARTMENT
BUREAU OF NAVIGATION

UNIV. OF
CALIFORNIA

U. S. NAVY EDUCATION

STUDY COURSES

MANUAL OF STANDARD PRACTICE
AND ANNOUNCEMENT OF COURSES

PREPARED FOR

THE VOLUNTARY INSTRUCTION
OF THE ENLISTED PERSONNEL

THE EDUCATIONAL WORK OUTLINED IN THIS
PAMPHLET SUPPLEMENTS THAT NOW
BEING GIVEN IN THE NAVY

NAVY DEPARTMENT
BUREAU OF NAVIGATION
MARCH, 1922

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

UNIV. OF CALIFORNIA

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"It is just as much the duty of officers to educate men for our trades as it is to train and drill them at stations. Unless we both *educate* and *train* green men in our trades, we cannot keep our mechanisms in condition for battle or ready for war. No amount of training at battle stations will keep our ships efficient unless our men are also *educated* to handle, care for, and maintain our equipment."

Letter of Instructions No. 2–21, ———— Force, ———— Fleet, 28 June, 1921.

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FOREWORD.

The mastery of modern naval practices, by reason of the complex and intricate mechanism involved, requires thorough skill.

The vital importance of personnel in the Navy to-day focuses the attention on the individual. We must draw from each individual man the best he has to give. The first step toward this is to offer him every opportunity to learn how to do his work each day efficiently.

The Navy Education Study Courses have been designed for this definite purpose. They give the men opportunity to combine the study of theory with the actual practice in their daily naval duties; to study a principle and then see its working out on the ship itself. Experience has shown that certain vessels which have encouraged the use of "rating courses" have increased the efficiency of their personnel and decreased their operating costs.

An examination of the courses herein outlined will prove that they are not offered with any idea of diverting the ship from its ambition to become a fighting unit. On the contrary, each subject is so related to some naval duty that it directly bears on the military efficiency of the command.

EDWIN DENBY.

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THE PURPOSE OF NAVY EDUCATION STUDY COURSES.

No command can reach its highest efficiency unless the personnel is adequately trained in technical duties.

Experience alone is a slow teacher. To learn to do solely by doing and find the best way through the trial and error method is a wasteful procedure. A simple form of technical instruction plus experience produces a more rapid and satisfactory method of training. With a few months' study of the Navy Education Courses advantage may be had of the lifetime experience of other men in the various technical lines.

The primary object of these courses is to aid commanding officers in obtaining a higher degree of efficiency from their personnel, and thereby produce a more effective Navy. The secondary object is to enable enlisted personnel to become more proficient in their present ratings, to attain advancement in ratings, and at the same time to become better equipped individuals.

Courses built on the correspondence-school plan have been used in order to present the subject matter of each course in the simplest and most practical way. These are mastered by the man through self-instruction plus the personal help and guidance of the officers. The only assistance which the student requires is in the selection of his course, the correction of his assignments, occasional explanation of problems, encouragement, etc., by either officers or capable petty officers.

References to certain books for study and supplementary reading are inserted in many of the courses. The object of these references is to encourage the individual to perfect himself in the field covered by the course. These books should be kept in the crew's library.

Unofficial reports from commanding officers indicate that until men show an earnest desire to study they should not be urged to take up courses, but that the amount of interest taken in this work by the men will be only proportional to the interest shown and the assistance rendered by the officers.

The Bureau of Navigation has consulted with the various other bureaus in the selection, revision, and adaptation of courses and texts, in order to establish a close and practical relationship between courses and ratings.

Educational courses best adapted for Navy use have been selected from the leading correspondence schools and universities of the country. Although such material has proved fully satisfactory, the bureau is issuing certain specially constructed courses by naval officers of the bureaus concerned. Courses have already been produced on "Boiler Operation," "Deck Artificer Ratings," "Pumps," "Marine Steam Turbines," "Chemistry," "Pharmacy," and "Elementary English."

If these courses are issued to capable and ambitious men, their value will be apparent. They will not, however, make any marked contribution to the general efficiency of the ship unless they receive the full support of the ship's officers.

EXPLANATION OF THE PLAN.

The Navy Education System has the following **basic features:**

1. The Educational service shall be offered **to all enlisted men of the Navy.**

2. The Educational system **may be installed** in any ship or station **upon the official request of the commanding officer.**

3. Enrollment for courses shall be **optional** on the part of all men.

4. The work shall be done **on the individual's free time** and shall **not interfere with the ship's regular routine.**

5. Courses and textbooks shall be furnished **free of charge** to all enlisted men.

6. Study shall be done by the **self-instruction method** instead of the class-room method. If desired, however, courses **may be used as manuals of instruction for the ship's regular instructional periods.**

7. **Courses of study** are **built** on the **correspondence course plan,** this being the most practical form for self-instruction. The courses shall be of a **technical nature bearing directly on naval duties** and **closely related to naval ratings,** with **a few general courses** designed **to furnish a background** for those men who have not had the preparatory training necessary to the mastery of the technical courses.

8. Work accomplished shall be **entered on the man's service record.** He shall be granted a **certificate of attainment** for each subject completed, and a **diploma** for the completion of the entire course.

9. **An educational officer or officers shall be detailed** to encourage and aid the men in their studies, stimulate them to complete work begun, correct lesson assignments, assign grades, issue new lessons, etc.

10. **Organization details** of the Educational work on each ship shall be **left to the commanding officer** of that vessel.

11. **Educational advisers** with special training and practical experience will be **detailed** by the Bureau **to assist commanding officers** in installing Navy Educational courses, in working out the most practical organization, and in suggesting modern and effective educational methods.

ANALYSIS OF NAVY EDUCATIONAL WORK, MARCH, 1922.

Fleets.	Total requests.	Requests granted and work installed.		Total number men enrolled.
			Battleships.	
Atlantic	5	2	U. S. S. Florida U. S. S. Arkansas	500
Pacific	10	8	U. S. S. Tennessee U. S. S. Oklahoma U. S. S. Texas U. S. S. New York U. S. S. California U. S. S. Nevada U. S. S. New Mexico U. S. S. Mississippi	2,448
			Destroyers.	
Atlantic	147	134	.....	1,522
Pacific	106	44	.....	800
Asiatic	2	....	.....	
			Tenders and flagships.	
Atlantic	7	4	.....	317
Pacific	7	4	.....	200
Asiatic	1	....	.....	
			Train.	
Atlantic	2	1	.....	17
Pacific	8	7	.....	145
			Mine squadrons.	
Atlantic	3	1	.....	[1] 10
Pacific	7	....	.....	
			Special service and naval transport vessels.	
	10	5	.....	[1] 127
			Shore stations.[2]	
	36	7	.....	[1] 142
			Individual requests from ships and stations.	
	42	30	.....	
	393	247	Total enrollment.	6,228

[1] Figures approximate.

[2] Included in the total enrollment are six shore stations. The bureau regrets that its limited funds have not permitted a greater spread of educational work among shore stations.

REQUESTS FOR INSTALLATION OF NAVY EDUCATION.

Commanding officers desiring that this general voluntary educational program shall be placed in operation on board the vessels or at the stations under their commands should make official application as follows:

Atlantic Fleet and Pacific Fleet:

Battleships, train, and all other vessels except destroyer forces, address—

Bureau of Navigation, Navy Department, via official channels.

Destroyer forces, address—

Commander, Destroyer Force.

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PART I

MANUAL OF STANDARD PRACTICE FOR THE DIRECTION OF NAVY EDUCATIONAL WORK

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SUGGESTIONS AS TO HOW EDUCATIONAL COURSES MAY PRODUCE BEST RESULTS.

REQUESTS FOR ADDITIONAL EDUCATIONAL SUPPLIES.

Atlantic Fleet—
Battleships, train, and all vessels other than destroyers, address—
Bureau of Navigation, Navy Department, via official channels.
Destroyer force, address—
Educational Officer, Atlantic Destroyer Squadrons.
Pacific Fleet—
All vessels, address—
Educational Supply Base, (now) Administration Building, Naval Repair Base, San Diego, Calif.
Foreign and special duty, address—
Bureau of Navigation, Navy Department, via official channels.

ENROLLMENTS.

Careful enrollment is a long step toward successful educational work.

1. **Educational advisers** are on duty at both the Atlantic and Pacific coasts and will assist the commanding officer with enrollment. Their familiarity with the courses and their practical experience will greatly help officers interested in making effective enrollments and organization.

2. The following is suggested as the **most practical method of enrolling:**

(*a*) **Preliminary conversation** with educational advisers when practicable.

(*b*) **Obtain list of courses and samples** from Bureau of Navigation or educational adviser.

(*c*) **Give publicity** to ship's company. Battleships publish at quarters and use bulletin board. Small vessels arrange for informal talk. The commanding officer, or his representative, should be able to express general scope as well as advantages of free educational courses.

Bulletin board notices to be effective should be full of punch and to the point. The following are examples of bulletins which were worked out by one commanding officer and used with good results:

BULLETIN No. ——.

Are you satisfied with life?

If not, why not?

Do you know where you are headed?

A ship headed for no port at all will never reach any port. The same is true of *you.*

Capitalize your spare time. Devote it to making yourself a more valuable man, which will mean more happiness and success for you. *Also more money if you save some of it as you earn it.*

Owing to the lack of funds for fuel, the cruising of this ship during the next three months will be much less than the previous three months, and will allow more leisure time for educational work.

There will be many opportunities to study and to increase your earning capacity either in the service or on the outside. The reading room will be available always for study and reading—nothing else.

The Navy Education System offers you various courses of instruction free of charge. *Each course successfully condenses a lifetime of experience into a few months' study.* Why not learn from other men's experience.

If you are in earnest when you say to yourself that you must do something to permanently increase your earning capacity, then enroll and take the course of training which is along the line of your naval duties or which appeals most to you. It is a step which you will never regret.

Lieut. ———— is ready at any time to advise and enroll you.

....., *Lieutenant Commander. U. S. N., Executive Officer.*

POSTER.

WILL LIFE FOR YOU BE A SUCCESS OR FAILURE?

DO YOU KNOW

The Short Cut to Success
In Any Trade Is a Thorough
Knowledge of That Trade.

A
NAVY EDUCATION
COURSE

Will Give You Practical
Training, Will Help You
To a Higher Rating, and
Will Better Fit You for
Life.

IT'S UP TO YOU.

(*d*) **Men** desiring to enroll, **report to** designated place to **look over sample courses** and confer with educational officer or adviser.

(*e*) **Take names of men and courses desired.** Forward letter to nearest educational supply depot or bureau, requesting number of courses desired in each subject.

(*f*) On receipt of courses, send for men enrolled. **Issue first lessons,** and give instructions as to study, turning in of finished assignments, etc.

(*g*) **Simple records** of courses received, names of students, date of enrollments, date of issue and return of lessons, grades for completed assignments, etc., should be kept by one of the ship's officers assisted by an efficient yeoman or non-rated man.

(*h*) **An officer,** appreciative of the value of these courses in the training of his men, should be placed **in charge** of these courses, if practicable.

3. CAUTION.

(*a*) **Not more than two courses at a time** are recommended for one man. Spelling, penmanship, arithmetic, and English are excepted.

(*b*) In certain cases it is good practice to let a man learn for himself that he needs to study elementary mathematics in order to master a technical subject, but as an educational foundation is necessary, it is wise to advise student to **first take up simple course** in mathematics or English. After deficiencies have been corrected he may then take up a technical subject.

(*c*) Men usually do the best work in **subjects** most **closely related to their work,** but as intellectual progress in any subject increases man's value to ship, individuals showing interest in special subjects should be encouraged.

(*d*) The individual will be aided if he will read and **study the references to books** indicated in the courses. By such study and reading he will acquire a wide knowledge of the subject and will more quickly prepare himself for advanced work. To those men interested in self-education the supplementary readings suggested will open up a wide range of possibilities.

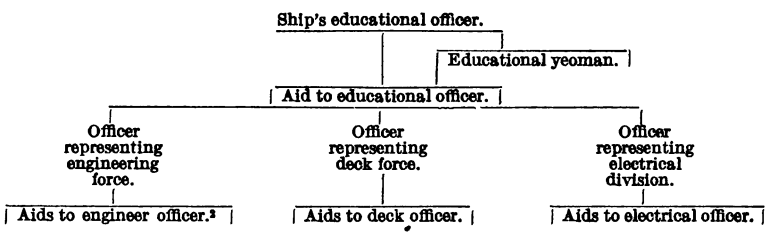
(*e*) Experience tends to indicate that approximately 10 per cent of complement of battleship make satisfactory progress. Courses should, therefore, be given **primarily to capable, steady, and ambitious men.** The limitation applies more especially to battleships.

SUPERVISION OF COURSES.

1. Past experience shows that the Education System, as installed on any one ship, stands or falls by the supervision of the officers to whom the work is intrusted. The interest and enthusiasm of the enlisted personnel has been found to be **uniformly good.** If it does not **remain so,** it is a direct reflection upon the methods in use, and is generally the result of a **lack of supervision and interest by the officers concerned.**

2. **The following is suggested as the organization for general supervision, correction of papers, consultations, follow-up** of individual's progress, etc.

ORGANIZATION FOR BATTLESHIP.[1]



[1] It will be necessary to modify this for destroyer or smaller type of vessel.
[2] In exceptional cases men below the grade of chief petty officer may be found capable of grading papers.

NOTE.—In cases of **detachments, or transfers of educational officers or assistants,** the commanding officer should provide that officer or man "turns over" educational duties to his relief with explanation of necessary operation. This is most important that the educational work may continue unbroken.

3. It is not deemed necessary for commissioned officers to actually correct papers or personally instruct classes, except perhaps in a few advanced courses. Where well-prepared warrant or petty officers are available as assistants, much of this detail work should be intrusted to them, under thorough supervision of commissioned officers.

4. **Keys** giving solutions and answers to the questions and problems contained in these courses are to be placed in the hands of the officers responsible for the grading of papers. These keys are to be considered confidential. Officers are requested to guard them with the strictest care. This is vitally important that the original work of students may not be thwarted by these keys falling into their hands. It is also

due to the publisher that his field should not be interfered with by the keys getting outside the service into city schools where corresponding textbooks have been adopted. Keys on the various subjects may be obtained from the bureau by official request.

5. It will be found that interested students will work out most of their problems alone, and that petty officers detailed to assist will in most cases cooperate willingly. Nevertheless, **the ship's educational officer should check up** (through division representatives) **progress** made each week. Division representatives should, in turn, weekly inspect work of enlisted assistants.

6. **Progress reports should be demanded monthly.** Under normal conditions and when all reasonable encouragement and help have been given a man and he has not turned in an assignment within a month's time, he should return course material and be stricken from records. Courses returned should then be reissued to other students or returned to the Bureau of Navigation.

7. **Examination questions** should be requested officially upon completion of subject. They should come through the Bureau or through the force educational organization, in order that standards may be maintained upon all ships. Examination papers should be corrected by a commissioned officer designated by the commanding officer. Graded papers will then be sent, for approval, to the Bureau of Navigation, Educational Section, where they will be filed and appropriate certificates of attainment forwarded to the commanding officer. Special attention should be paid to officer's special knowledge of subject in question. The Naval Academy scale of grading should be used.

8. (*a*) **Certificates of attainment** (procured from Educational Supply Depot or Bureau of Navigation) should be signed by commanding officer and issued to all students successfully completing a subject. (See Part II, par. 6.)

(*b*) **Diplomas** (procured as in (*a*)) signed by Chief of Bureau of Navigation are issued on completion of a course. (See Part II, par. 6.) Certificates and diplomas (or copies) should be attached to service records.

9. Commanding officers will find that designated **office space** is essential for proper distribution of courses, filing of records, etc. A reading room or **study compartment** where silence is maintained will enable men to advance themselves more rapidly in their courses and, therefore, in their ratings.

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10. (*a*) **Additional enrollments** may be made through reissuing used or returned courses, or through an additional request.

(*b*) **Unused material** should be returned to the bureau and checked off supply record.

(*c*) **Men transferred** should carry remaining assignments of subject to new duties. When practicable, letter should be addressed to new commanding officer advising of work accomplished by student. **Men discharged** should return all books and courses to ship's educational office before "clearing ship."

11. **Enlisted man's rating record.**—Grades for work done in Navy Education Study Courses should be permanently recorded on Enlisted Man's Rating Record as follows:

EDUCATIONAL RECORD OF ----------

(To be permanently attached to service record.)

[Scale of marks: 4.0, excellent; 3.5, very good; 3, good; 2.5, passing; 2, fair; 1, indifferent; 0, bad.]

Ship.	Quarter ending or date of transfer.	Name of subject and number of assignment.	Grades.		Recommended for further instruction.	Executive officer's signature.
			Average on assignment.	On final examination.		
U. S. S. ——	Apr. 1, 1922	Boilers: Oil-fired. Assignment, 1-15.	4.0	3.5	Yes...	Commander ——

CONSULTATIONS AND CORRECTION OF PAPERS.

(*a*) **Lessons may be corrected** by competent men under supervision of officers. (See par. 3 of foregoing section.)

(*b*) **Answers to questions** (at conclusion of each lesson) should be turned in each week to ship's educational office or to some person designated.

(*c*) **Grades** should conform to Naval Academy system. **A conference should be held with each man** who hands in written work each week. The conference may be with individual or in groups. The student's errors should be pointed out and he should be encouraged for any satisfactory progress shown.

HOURS FOR STUDY AND INSTRUCTION.

(*a*) **Men study outside of working hours,** excepting in ship or forces where a regular study or instruction period is designated. Individual study permits as rapid advancement

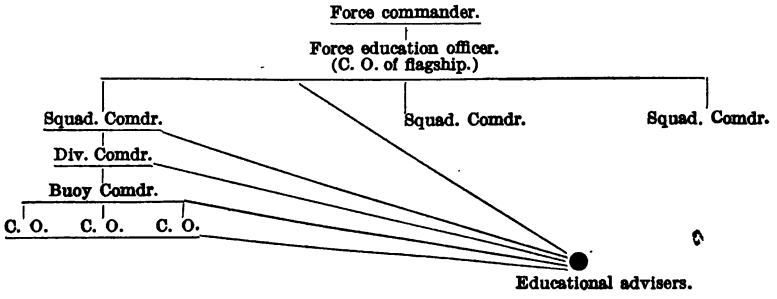
as the student is capable of and is at its best when ship's activities are keenest. In the case of shortage of material, it may be found advantageous to have two men study together. Groups or class instruction may also prove advantageous when a group of men from the same "gang" have taken up the same course.

(*b*) **Instruction periods.**—Some ships have done good work without instruction periods, but they aid materially in the successful operation of courses. In one instance the half hour between 8:15 and 8:45 has been set aside five days a week as an instruction period. Navy Education Courses may be used for the instruction of individual men in cases where the course applies to the regular rating or to the rating for which a man may be striking. Experience tends to show that progress is far more certain and rapid when such a period is observed. In certain forces, courses bearing directly on a man's duties are studied on ship's time; all other courses are studied on man's own time.

REPORTS.

Report forms showing increase or decrease of enrollment, assignments completed, etc., are forwarded on the first of each month to the bureau. They are not used to demonstrate comparative progress of units, and are so constructed as to require merely the copying of monthly records of the ship's educational office, and should constitute no additional "paper work." They are essential to the bureau in forecasting changes in curriculum, stock demands, etc. It is earnestly desired that commanding officers insist on accurate and prompt reports, so that the bureau may provide for the field in an intelligent and efficient manner.

SUGGESTIVE FORCE ORGANIZATIONS.



MAINTAINING PRODUCTIVENESS OF COURSES.

1. The Navy Study Courses are now being used by 213 ships and shore stations and are **well beyond the experimental stage.** In the hands of an officer with initiative, intelligence, vision, and leadership, this educational system has proved to be a dynamic force for the surest and largest accomplishment of his task. The best use of these courses will so make for improved efficiency and a fuller functioning of the personnel in hand that economical results should follow—more work and greater effectiveness with the same force—has been demonstrated. Most practical and immediate results should be obtained, as the men are studying the very tools used by them in their everyday work.

2. **Difficulties.**—Commanding officers interested in developing the efficiency of personnel through courses will find at certain periods a **falling off** of interest. This will probably be due to one of the following causes: Natural let down after first enrollment; inactivity of educational officer, division representatives, or assistants; navy-yard periods, etc.; transfer or detachments. Success will vary, and progress will be made in a series of spurts, with the leave and overhaul periods as the slack times. When ship is facing extraordinary activities, educational officer and aids should see that educational organization is functioning at its best to overcome other emphases. It has been demonstrated that practical educational work related to ratings may be carried through a *falling-off* period, involving cruises and difficult duty. The natural **difficulties mentioned may be overcome.**

(*a*) **Natural let down** after first enrollment. **It is expected that certain men will lose interest.** If a falling off of interest is observed, it is recommended that individuals concerned be interviewed.

(1) It should be ascertained from officer or petty officer directly in charge of student's naval or routine duties whether he is **attempting to study a course too advanced** for his education. If so, he should be given a more elementary one as a preliminary step.

(2) Inquiry should be made as to whether he has been able to receive **weekly consultation and assistance** from his divisional representative.

(3) If the lack of progress may not be attributed to the foregoing (or other reasonable cause), it is recommended that his course be returned to the ship's educational office, and that his **name** be **stricken from the enrollment records.** Another man may be given his course.

(*b*) **Inactivity of educational officer, division representatives, or assistants** is ordinarily due to a lack of interest in or knowledge of the benefits to be derived from a well-trained enlisted personnel. It is therefore suggested that the matter be **impressed on them as a part of the ship's program** in attaining the highest possible degree of efficiency.

(*c*) **Navy-yard periods.**—It is to be expected that interest in and study of courses should decrease during target practice, navy-yard periods, etc. Courses are so constructed that the **work may be resumed without loss** if the educational officer maintains the simple organization intact.

(*d*) **Transfer or detachment.**—In many instances ships doing excellent educational work have almost immediately ceased showing progress when one or more of the officers most concerned with this work have been detached. It is believed that the work may be carried on without interruption if **the relief** has been **indoctrinated** with the advantages and operation of courses.

(*e*) **The bureau will gladly furnish** commanding officers with any **information** they may desire, to further the successful maintenance of courses.

The Bureau of Navigation is the Bureau of Personnel. Consequently, the Bureau of Navigation is vitally interested in this effort to increase the proficiency of the personnel.

In this connection the bureau will be grateful to receive any comments or criticisms from commanding officers on the general operation of these courses and will forward any information desired by officers in the fleets.

Information is being gathered as to methods which have proved successful in various units. Copies of these methods will be forwarded on request.

DUTIES OF YEOMAN HANDLING COURSES.

I. RECORDS.

(*a*) **A record should be kept of all material received,** *noting titles and number of assignments. This record may be known as the "Educational Stock Record," and will be found to be most conveniently kept on 5 by 8 cards filed by subject. The following form is suggested:*

Steam Engineering—
Practical Steam Engineering.

U. S. S. Cable
Educational Stock Record

Date.	Assignments.																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Jan. 2, 1922. Received	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Jan. 8, 1922. Received	5	5	5	5	5	5	5	5	5	5	..	..	..	..	..	..	..	..	..	..
Total	30	30	30	30	30	30	30	30	30	30	25	25	25	25	25	25	25	25	25	25
Jan. 9, 1922. Returned to Bunav	10	10	10	10	10	10	10	10	10	10	..	..	..	..	..	..	..	..	..	..
Feb. 4, 1922. Returned to educational officer, Charleston	5	5	5	5	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	15	15	15	15	15	20	20	20	20	20	25	25	25	25	25	25	25	25	25	25

(*b*) **A record should also be kept of material issued to men,** *and may be combined with the* **record of enrollments and progress.** *The following 3 by 5 card is recommended and should be filed alphabetically under the man's name:*

[Front of card.]

ENROLLMENT CARD.

....
(Last name.) (First name.) (Ship.) (Div.)

Enrolled..... Rating.....

Years in grammar school..... High school..... College.....

[OVER.]

[Back of card.]

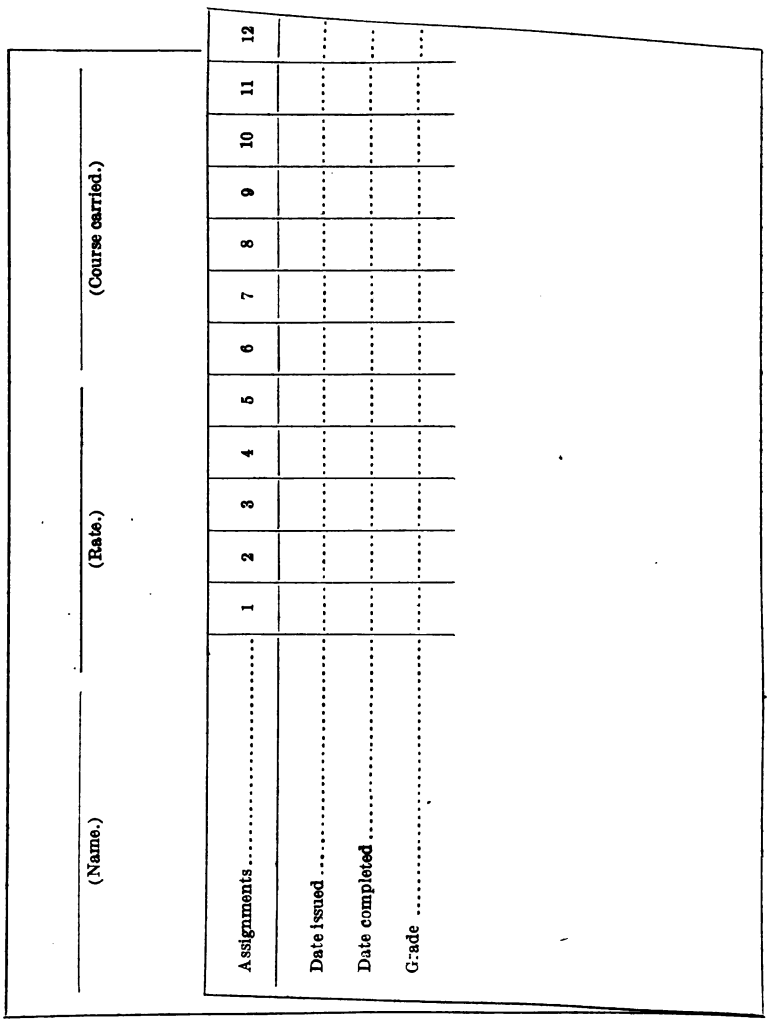
PROGRESS.

Subject.	Assignment No.	Date taken.	Date returned.	Grade.

An alternative plan for this enrollment and progress record card is one that was worked out by some destroyer vessels for their own use.

A heavy manila folder bears on the index tab the man's name and name of course being pursued; on the front of folder, the record of progress; while the unused parts of courses begun and letters of record are filed inside the jacket. These folders are kept in vertical file alphabetically under the man's name. The two forms submitted are as follows:

FORM I.



FORM II.

(Name.)

COURSES UNDERTAKEN.

ENGINEERING.			GAS AND OIL ENGINES.			ELECTRICITY.		
No.	Commenced.	Completed.	No.	Commenced.	Completed.	No.	Commenced.	Completed.

EXAMINATIONS.

ENGINEERING.			GAS AND OIL ENGINES.			ELECTRICITY.		
No.	Commenced.	Completed.	No.	Commenced.	Completed.	No.	Commenced.	Completed.

.....

NOTE.—These cards should be kept accurately and up to date, so that the commanding officer's monthly reports to the bureau or to the force educational officer may be made out easily and with promptness.

II. EDUCATIONAL MATÉRIEL.

(*a*) On receiving educational matériel, it should be **sorted** so that each course stands as a whole; that is, **assignments** should **follow in sequence** (or rotation).

III. HOURS.

(*a*) **Hours should be posted** when educational yeoman is in office, so that men may know when to turn in completed assignments and draw new ones.

IV. REQUESTS.

(*a*) **Requests for new courses** should be **transmitted without delay** to the educational officer. The educational officer should be informed daily of conditions in the educational office, and should keep in constant touch with the needs of the men. A personal interview with a man is worth a dozen notices, announcements, etc., in keeping up his interest and enthusiasm.

NOTE FOR EDUCATIONAL OFFICER.

The bureau is of the opinion, first, that a certain percentage of the enlisted personnel afloat will earnestly study courses on their own time; second, that the majority of enlisted personnel taking them show improvement in their naval duties; and third, that distribution of courses by the bureau tends to raise the general standard of the personnel.

The suggestions contained in the foregoing paragraphs may provide a practical outline. The actual organization is left, however, with the individual educational officer, with the realization that each ship will work out the most effective methods of improving the efficiency of its own men.

SUGGESTIONS TO STUDENTS.

NOTE.—Some, or all, of the following notes may be copied for bulletin boards, or distributed to students.

Men have earned warrants and commissions through hard work plus the knowledge gained through books and correspondence courses.

You also may improve your education and advance yourself.

Educational courses are of little value unless you are willing to put real study in them. They will give you education only in exchange for perseverance and work.

The following hints may help you to get ahead:

1. Promise yourself to **study a half hour or an hour a day** and stand by your promise. If you cannot get in half an hour on one day make it up on the following. Remember other men have advanced themselves under like circumstances and you can do the same.

(*a*) **The first and most important point is perseverance.** In the face of all interferences and obstacles keep on studying. The man who sticks wins more surely than the brilliant man.

(*b*) **Pick out as quiet a place** as you can find and make the habit of going there to study every day.

(*c*) When you sit down to study, **keep your mind on the lesson, and keep "digging at it."** You will get interested in your work and the more you study the better you will like it. In technical subjects, drawing rough sketches or diagrams of machinery or problems will usually help you to concentrate your attention when you find it hard to study.

2. (*a*) If you cannot understand the lesson, **talk it over with some other man taking the same course.** If he cannot help you, talk it over with a chief petty officer or an officer at a convenient time. While you are waiting to talk it over, see if you can't do the rest of the lesson.

(*b*) If you are sure you have worked out the first lesson the best you can, hand it in and get it corrected and **start on the next one.** If you think there may be some mistakes, talk it over with the officer or enlisted man who is helping you. Then go on to your next lesson. If you have been told to have each lesson corrected by some officer or man, take your work to him when you finish first lesson.

(*c*) **If you strike a hard problem, wrestle with it,** and in most cases, **you can work it out.** If you are sure, however, that the whole course is too deep, ask the educational officer for another course that is not so advanced.

(*d*) **Don't try to do too much at once.** If you study one subject at a time you will be making good progress. Stick to that one subject. Do it well, and go on to the next higher one when you have finished the first one.

3. Develop the habit of **linking up your studies with your everyday experiences.** Look for opportunities in your regular work to use the knowledge you have gained.

(*a*) If you are in the engineer force, **work out your problems by figuring out the equipment in the engine room.**

(*b*) If you are taking an English course, **try to write your letters according to what you have learned. Draw** a good interesting **book from the library** and take notice of how it is written.

(*c*) If you are taking a course in navigation, **check up what you have learned by whatever you see or hear** on the deck or bridge.

(*d*) If you are taking an advanced course, try to **get a book on the same subject from the library** and study that along with the course. You will find various books referred to in certain of the courses. Borrow these books from the library; read the sections indicated and make sure you thoroughly understand them. By such reading you will prepare yourself for more advanced courses and will obtain a better knowledge of the subject. Don't be satisfied with the explanation of a single textbook, but read as many books as you can borrow from the library, and see what others have to say on the same subject.

(*e*) **Keep** a small inexpensive **dictionary** in your bag or locker.

PART II

NAVY EDUCATION STUDY COURSES OFFERED

NAVY EDUCATION STUDY COURSES OFFERED.

1. **Instruction.**—The various subjects are taught through a series of lessons, which are built on the self-instruction plan used by the best university extension departments and correspondence schools throughout the country and adopted in the courses constructed by the different bureaus of the Navy Department. These subjects are furnished to the ships complete in quantities requested, but are issued to the man one assignment at a time. Such an assignment includes or cites the part of the text that is to be studied, detailed instructions explanatory of the material assigned and questions to be answered. In addition to this self-help material, motion pictures and charts will be used when possible. The counsel of the special educational officer will be available, as well as the helpful interest of all the ships officers. Furthermore, for many of the courses the ship should be used as a laboratory, that is, the particular line of work, the theory of which is covered by these courses, can be seen and studied in actual operation aboard the ship itself.

2. **Advice and direction.**—The educational officer or one of his representatives will have a definite schedule of office hours, during which period he will be accessible to any men, not otherwise employed, who desire to start courses, obtain lesson sheets, turn in finished lessons, or obtain advice. Men should be encouraged to study the courses pertaining to or closely allied to their everyday naval duties.

3. **References for additional reading along line of study.**—Inserted in the courses are references to books for additional reading and study. Such books, if not on board, may be requested by the commanding officer from the bureau. They should be issued only through the crew's library, being charged out in the same manner as other books. Upon return they should be loaned to other students as demanded. If use justifies, the bureau will supply duplicate copies.

All men taking these courses should make use of the supplementary reading indicated. The use of this material will be of great value in acquiring a more comprehensive knowledge of the subject, in preparation for more advanced courses, as well as in forming the habit of the use of books for reading and study.

4. **What is meant by course and subject.**—Throughout this manual the term **course** shall be used to indicate the larger divisions, as ordnance and gunnery, steam engineering, yeomanry, etc. Each course shall be made up of a number of smaller divisions which shall be known as *subjects* (sometimes referred to as courses of study or courses of instruction), such as:

Steam engineering (course).
Subjects:
- Practical steam engineering.
- Boiler operation.
- Pumps.
- Steam turbines.

5. Navy Education offers **eleven courses and certain general subjects.** These are as follows:

Navigation.
Seamanship.
Ordnance and gunnery.
Deck artificer.
Communications.
Steam engineering.
Electrical engineering.
Gas engineering.
Yeomanry.
Commissary.
Pharmacy.

General Subjects.

Under each of these eleven courses come certain technical or scientific subjects applicable to that particular course, and in addition to these, certain nontechnical or general subjects which are considered as essential for a background. Certificates of attainment will be issued to all students successfully completing any subject, whether technical or general. In order for a student to receive a *diploma covering an entire course*, he must hold certificates of attainment for each of the subjects listed as forming part of that particular course.

The **subjects offered in the eleven courses,** as well as the general subjects, shall be as follows:

Course I. NAVIGATION.

Technical subjects.

	Number of lessons.
Ocean and coast navigation	12
Nautical astronomy	15
International law	15
Geography	Textbook.

Nontechnical subjects.

English. Mathematics.

Course II. SEAMANSHIP (in preparation).

Course III. ORDNANCE AND GUNNERY (in preparation).

Technical subjects.

Ordnance material—Care and preservation.
Ammunition and ammunition stowage.
Guns and mounts.
Torpedoes.
Turrets.
Fire control.
Safety precautions.

Nontechnical subjects.

English. Mathematics. Physics.

Course IV. DECK ARTIFICER (in preparation).

Technical subjects.

	Number of lessons.
Carpenter's mate 3c, qualifications for	26
Carpenter's mate 2c, qualifications for	26
Carpenter's mate 1c, qualifications for	26
Carpenter's mate, chief, qualifications for	26
Shipfitter 3c, qualifications for	26
Shipfitter 2c, qualifications for	26
Shipfitter 1c, qualifications for	26
Shipfitter, chief, qualifications for	26
Painter 3c, qualifications for	26
Painter 2c, qualifications for	26
Painter 1c, qualifications for	26
[redacted]	
Blacksmith [redacted], qualifications for	26
Blacksmith 1c, qualifications for	26
Patternmaker (in preparation).	
Sailmaker (in preparation)..	
Printer (in preparation).	

Nontechnical subjects.

English. Mathematics. Mechanical drawing.

Course V. COMMUNICATIONS (in preparation).

Technical subjects.

Radio.
Sound apparatus.
Signals.

Nontechnical subjects.

English. Mathematics. Physics.

Course VI. STEAM ENGINEERING.

(Courses for advancement in ratings of water tenders, machinist's mate, boilermakers, coppersmiths, enginemen, molder, and firemen.)

Technical subjects.

	Number of lessons.
Practical steam engineering	20
Boilers:	
(I) Boiler operation—	
(*a*) Boilers, oil-fired	15
(*b*) Boilers, coal-fired	12
(II) Boiler care (in preparation).	
(III) Boiler repair (in preparation).	
Steam boilers (advanced)	20
Steam engines	20
Marine steam turbines (elementary) in preparation:	
Pt. I. Curtis turbine	12
Pt. II. Parsons turbine	12
Pt. III. Westinghouse turbine	12
Pt. IV. De Leval, Sturtevant, and Terry turbine	12
Steam turbines (advanced)	20
Pumps	10
Heat (advanced)	16
Refrigeration	20
Coppersmithing (to be prepared).	
Molding (to be prepared).	

Nontechnical subjects.

English. Mathematics. Physics. Mechanical drawing.

Course VII. ELECTRICAL ENGINEERING.

Technical subjects.

	Number of lessons.
Practical electricity	20
Elementary magnetism and electricity	10
Theory and operation of direct-current machinery	10
Theory of alternating currents	20
Searchlights (in preparation).	

Nontechnical subjects.

English. Mathematics. Physics. Mechanical drawing.

Course VIII. GAS ENGINEERING.

Technical subjects.

	Number of lessons.
Gas and oil engines, Course I	10
Gas and oil engines, Course II	10

Nontechnical subjects.

English. Mathematics. Physics. Mechanical drawing.

Course IX. YEOMANRY.

Technical subjects.

	Number of lessons.
Manual of Office Procedure, U. S. Navy (in preparation).	
Typist's Guide—From Sight to Touch	6
Rational typewriting	36
Lessons in Gregg shorthand with test exercises (each)	20
Elementary bookkeeping	10
Elementary accounting	16
First lessons in business	20
Business law	20

Nontechnical subjects.

Penmanship. Mathematics. Spelling. English.

Course X. COMMISSARY (in preparation).

Technical subjects.

Cooks and bakers.
Stewards.

Nontechnical subjects.

English. Chemistry. Penmanship.

Course XI. PHARMACY.

(Courses for advancement in ratings of pharmacists' mates.)

Technical subjects.

Anatomy, physiology, and first aid.
Chemistry, organic and inorganic, for pharmacy students.
Pharmacy.

Nontechnical subjects.

English. Mathematics.

GENERAL SUBJECTS.

	Number of lessons.
Spelling, Navy Speller	155
Penmanship, Palmer Method of Business Writing	146
Arithmetic	7
Elementary algebra, Courses A–1, A–2, A–3 (each)	24
Plane geometry	20
Solid geometry	10
Plane trigonometry	24
Practical calculus	10
Navy primer	26
Plain English	20
English for enlisted men	20
Drills in effective English and letter writing	33
Elementary chemistry	82
Elementary physics	40
Mechanical drawing	40
Elementary United States history and government	20
Civics (in preparation).	
Elementary Spanish	20
Advanced Spanish	20

TEXTBOOKS REQUIRED FOR CERTAIN SUBJECTS.

Many courses are complete in themselves, but some require extra textbooks. The following textbooks accompany the subjects specified and should be issued with these courses of study when given out:

Textbook.	Subject.
Azimuths of the Sun	Ocean and coast navigation.
Bowditch: American Practical Navigator	
Bowditch: American Practical Navigator	Nautical astronomy.
Hosmer: Navigation	
Nautical Almanac	
Lawrence: Principles of International Law	International law.
Documents Illustrative of International Law	
Pate: Naval Artificer's Manual	Deck artificer's courses.
Carmichael: Practical Ship Production	
Bu. C. & R.: Sailors Manual of Paints and Painting	
Instructions for painting and cementing vessels. General specifications—Appendix 6	
Moyer: Steam Turbines	Steam turbines (advanced).
Rowe: Bookkeeping and Accounting, including budgets 121 to 124	Elementary bookkeeping.
Rittenhouse: Accounting Theory and Practice, Unit I, with practice sets	Elementary accounting.
Bexell: First Lessons in Business	First lessons in business.
Hirschl: Business Law	Business law.

Wells & Hart: New High School Algebra	Elementary algebra, A–1, A–2, A–3 (University of Oregon course).
Wentworth & Smith: Academic Algebra	Elementray algebra (Massachusetts course).
Wells & Hart: Plane geometry	Elementary geometry (Massachusetts course).
Wells & Hart: Solid Geometry	Solid geometry (Massachusetts course).
Ford & Ammerman: Plane and Solid Geometry	Plane and solid geometry (University of Missouri course).
Wentworth & Smith: Plane and Spherical Trigonometry	Plane trigonometry (Massachusetts and Oregon courses).
Various authors: Plain English	Plain English.
Kennedy & Bridges: Effective English and Letter Writing	Drills in effective English and letter writing.
Blount & Northup: Elementary Grammar with Composition	English grammar with composition.
Millikan & Gale:	
First Course in Physics	Elementary physics (old course).
Practical Physics	Elementary physics (revised course).
Remsen: College Chemistry	Elementary chemistry.
Kahlenberg: Laboratory Exercises	
Woodburn & Moran: Elementary American History and Government	Elementary United States history and government.
Dunn: Community Civics	Civics.
Hills & Ford: First Spanish Course	Elementary Spanish.
Alarcon: El Capitan Veneno	
Olmsted & Gordon: Spanish Grammar	Advanced Spanish.
Whittem & Andrade: Spanish Commercial Correspondence	

DESCRIPTION OF COURSES AND SUBJECTS.

Course I. NAVIGATION.

OCEAN AND COAST NAVIGATION. (A practical elementary course on navigation.)

This course of study is based on 40 years of actual sea experience and was further revised by the head of the department of seamanship of the Naval Academy. It covers navigation from A to Z in a complete but elementary form, and presents the subject in the way the practical man of long sea experience knows it. It so simplifies Bowditch that only an ordinary knowledge of arithmetic is necessary for the mastery of it.

NAUTICAL ASTRONOMY.

A more advanced study of astronomy as applied to navigation. It was prepared by the University of California, in cooperation with the Naval Academy, as a course for practical seamen. The course deals in general with the principles and rules of mathematics as used by navigators; piloting; charts; compass errors; sailings; dead reckoning; system of coordinates; mean, apparent, and sidereal times; use of nautical almanac; chronometer error and rate; sextant corrections; determination of longitude, time, latitude, azimuth, and amplitude; old and new methods of finding the Sumner line; finding the ship's position by the intersection of position lines; and a complete day's work. The student taking up this subject should have a knowledge of trigonometry and logarithms; however, if he is not familiar with these subjects, he should begin by studying Bowditch, Appendix III, which contains an elementary treatise on the rules and principles of mathematics required.

INTERNATIONAL LAW.

This course of study deals with the fundamental principles of international law as they have been developed through the practice and agreement of nations. Special attention is given to instructions for the United States Navy governing maritime warfare. The course is designed for those desiring a general knowledge of the subject, but it may be pursued with profit by officers studying for promotion.

GEOGRAPHY.

A study in geography presented in a new way. The earth's surface is divided into "natural regions." The climatic conditions, physical features, and natural resources of each are shown as shaping the activities and customs of the people living there. This study of the part played in the growth of civilization and in human affairs by geographic surroundings gives an idea of the connection between the geography, history, and literature of different parts of the world. This course emphasizes the commerce and industry of the world and the study of oceans and their relation to commerce, closing with a special study of the United States as a world power. A notable feature of the text is the variety and excellence of the colored map studies.

Course II. SEAMANSHIP (in preparation).

SEAMANSHIP.

The bureau realizes that long experience in the deck force is necessary to develop an efficient seaman. The course in question can never be considered as a substitute for such practical experience. It will, however, clearly outline technical methods, duties, and practices, enabling the average man to understand them more thoroughly and to perform them with greater skill.

The purpose of the course is to present in a clear and interesting series of lessons those subjects a competent seaman or boatswain's mate must know.. Material is being assembled and prepared by experienced naval officers.

Course III. ORDNANCE AND GUNNERY (in preparation).

ORDNANCE AND GUNNERY.

The purpose of these courses is to make the men proficient in ordnance and gunnery to the end that they may obtain higher ratings in these branches of the service. It is contemplated that seven courses will be constructed to cover the material on these subjects, as follows:

(*a*) Ordnance material—Its care and preservation.
(*b*) Ammunition and ammunition stowage.
(*c*) Guns and mounts.
(*d*) Torpedoes.
(*e*) Turrets.
(*f*) Fire control.
(*g*) Safety precautions.

These courses of instruction will take up in detail such subjects as: Naval rifled guns; naval gun mounts; the Waterbury hydraulic speed gear; breech mechanisms; naval gun sights; firing attachments and gas-expelling devices; care and preservation of ordnance material; reports and returns; the control of fire; electricity; use of tools and safety precautions; torpedo control, operation, care, and repair; torpedo tools; torpedo ordnance forms; turret operation and overhaul; turret fire-control system; and instruments and safety precautions.

The material will be selected from United States Naval Gunnery, 1913; United States Navy Gunnery Instructions, 1920; The Ship and Gun Drills, United States Navy, 1918; Naval Ordnance, United States Naval Academy, revised ed., 1921; Handbook for Seaman Gunners, 1918; bureau pamphlets; Reports of Gunnery Exercises, published semiannually; and Bluejacket's Manual, 1918.

Course IV. DECK ARTIFICER.

DECK ARTIFICER BRANCH—CARPENTER'S MATES, SHIP FITTERS, BLACKSMITHS, AND PAINTERS.

These courses of instruction for all ratings in the deck artificer branch were prepared by the Bureau of Construction and Repair. They outline all information which will make for proficiency in the various ratings of carpenter's mates, ship fitters, blacksmiths, and painters, and are recommended to applicants for advancement in this branch.

The subjects covered relate to the care and preservation of the hull and fittings and the care and operation of such naval auxiliary machinery and appliances under cognizance of the Bureau of Construction and Repair as are assigned to the deck artificers for upkeep and operation.

Elementary arithmetic has been included as necessary to insure a clear understanding of all problems likely to arise.

Instruction is given on miscellaneous subjects pertaining to all trades represented in the deck artificer branch, including nomenclature of general features of ships, nature of materials, piping systems, names and uses of tools, strength and weight of materials, types and classes of vessels, displacement and tonnage, etc.

Instruction is also given in the mechanical trades of the various ratings as follows:

Carpenter's mates.—Boat building and repairs, joiner and ship carpentering, spar making and general woodworking as required on naval vessels.

Ship fitters.—Ship fitting, pipe fitting and plumbing, acetylene cutting and welding, miscellaneous metal working.

Blacksmiths.—Forging, tempering tools, chain making, and miscellaneous blacksmith work.

Painters.—Formula for mixing paints, testing and care of paint materials, application of paints, instructions for painting and cementing vessels of the Navy.

Pattern makers (in preparation).

Sailmakers (in preparation).

Printers (in preparation).

Course V. COMMUNICATIONS (in preparation).

RADIO (in preparation).

SOUND APPARATUS (in preparation).

SIGNALS (in preparation).

Course VI. STEAM ENGINEERING.

PRACTICAL STEAM ENGINEERING. (A general course on steam engineering.)

This is a practical study of steam engineering, and begins with the simplest type of apparatus to show most directly the fundamental principles of how steam is used to do work. This course includes the following subjects: Steam boilers, fuels and firing, properties of steam, boiler auxiliaries, care of boilers and steam engines, principles of the steam engine, slide-valve setting, calculation of horsepower, steam-engine indicator, compound engines, steam-engine auxiliaries, etc.

BOILERS - OPERATION, CARE, AND REPAIR.

These courses on boilers were constructed by the Bureau of Engineering to conform with naval practice and are especially designed for naval use. They present to the student the rare privilege of having the machine which he finds discussed in the text at his hand for observation and study. He can thus much more readily grasp the principle of the operation which is taking place before his eyes. The primary object of the courses is to give the student approved naval methods of boiler operation, care, and repair.

These courses of instruction cover the information required for advancement in all ratings of the engineer department on board ship in so far as the operation, care, and repair of boilers are concerned. They will also aid in the preparation for the examination for "license as engineer of steam vessels."

Boiler operation.—The subject of boiler operation is covered by two courses: *Boilers, oil-fired;* and *boilers, coal-fired.* They treat thoroughly all the steps in boiler operation; how to light off and cut in; to cut out and secure, feeding boilers, firing boilers, and casualties.

Boiler care (in preparation).

Boiler repair (in preparation).

Steam boilers.—**(A more advanced course on boiler operation and equipment.)**

A course for the use of firemen and others in responsible charge of boiler rooms. It covers fully and practically boiler operation, care, and equipment, rather than boiler design. The course includes much descriptive matter relating to boilers and boiler-room equipment. It has useful material on efficient combustion and smoke prevention.

Topics treated.—Types of boiler flues and fire-tube boilers; water-tube boilers; boiler calculations; stays and staying; heat and work; effects of heat; properties of steam; actual and equivalent evaporation; fuels; chemistry of combustion; methods of firing; the smokeless combustion of coal; settings; piping and boiler fittings; boiler accessories, chimneys, and draft; boiler feed waters; feed-water heaters; inspection and care of boilers; boiler testing.

STEAM ENGINES.

This course of study gives the fundamental principles underlying the operation of the steam engine, explained in a simple nonmathematical manner. It is a practical course intended primarily for erecting and operating engineers, and to this end it deals with the erection and operation of practically all classes of modern engines. It treats of both theory and practice as applied to steam engines. It is written so that it may be studied by those who have had but little or no experience with steam engines, and at the same time it is advanced enough to benefit the experienced engineer. While the course deals largely with stationary engines, it is so arranged that both locomotive and marine engineers may benefit from it. Firemen and engineers seeking advancement will find the course in steam boilers and steam engines an excellent preparation for advancement in the ratings of the engineer department on board ship.

Topics treated.—Principles of the steam engine; properties of steam; action of steam in the cylinder; valve gears; governors and link motions; steam-engine economics; steam-engine accessories and settings.

MARINE STEAM TURBINES. (An elementary course.)

This course has been prepared with the object of giving condensed information as to the principal features of construction, the method of operation, and the proper care of marine steam turbines. These pamphlets have been written for the practical man who is not much concerned about "knotty" theories, but who is very much interested in practical operating results. Nevertheless, the fundamental principles are explained in such a way that the study can be pursued intelligently and profitably.

This course takes up the study of turbines of the Curtis, Parsons, Westinghouse, Sturtevant, Terry, and De Laval types. The construction and operation of steam turbines for marine service, including usually speed-reducing gears for the propulsion of ships, are entirely different from any of the types of reciprocating steam engines which are used for this service. For a number of years the reciprocating steam engine has been the accepted device, and has had very little competition for use in large ships; but now steam engines are being rapidly superseded by steam turbines. The practical marine engineer who has been quite familiar with the operation of steam engines of all kinds finds the motive-power parts, glands, bearings, adjustments, and method of lubrication of steam turbines entirely different from his previous experience. This course will give him the information and training desired.

STEAM TURBINES. (An advanced course on steam turbines.)

This course deals with the development, operation, and design of steam turbines. Characteristics of steam turbines are compared with steam engines for different services. Subjects treated include development of steam turbines; steam-turbine nozzles; blades or buckets for steam turbines; commercial types; impulse turbines; reaction turbines; mixed types of turbines; testing steam turbines; methods of correcting engine and turbine tests to similar conditions for comparison; steam-turbine economics.

Open to those who have had the course in practical steam engineering and trigonometry or their equivalent.

PUMPS.

This course was constructed by the Bureau of Engineering and is a complete but simple treatment of the care, operation, and repair of pumps as approved by the Navy.

The course covers reciprocating pumps; rotary pumps (including centrifugal and gear pumps); injectors and ejectors;

the operation, care, and repair of each, with a closing chapter on safety precautions. It includes the information required for advancement for all ratings in the engineer department on board ship in so far as the care, operation, and repair of pumps are concerned.

HEAT.

This course is a foundation for advanced studies, and is designed to supply the fundamental knowledge necessary for the successful study and understanding of all heat-using machinery. Part I treats of the fundamental laws relating to nature, generation, transfer, and transformation of heat, and presents familiar examples of their practical application in all cases. Part II discusses the principles of the steam engine, gas engine, refrigerating machine, and air compressor, and shows the relationship of heat to these classes of machinery. It is well adapted to the requirements of engineers and firemen who have had some experience with heat-using machinery and understand its operation, but feel that they do not know enough of the laws of heat to take up advanced or special subjects.

REFRIGERATION.

This offers a field which is far from being overcrowded with competent men; and it still affords many opportunities for original, progressive work.

The purpose of this course is to teach the fundamentals in the construction and operation of refrigeration systems, the applications of cold storage, and the insulation of refrigerated spaces. Though the object of the course is to be practical and to limit the discussion of theory as far as possible, at the same time it is thorough and begins with a review of facts about heat, temperatures, and units of measure. The other subjects treated are: Fusions of ice; evaporation of liquids; proportion of ammonia and other media; methods of refrigeration; properties of brines; types of compressors; condenser; cylinder cooling; wet and dry compression; cylinder clearance; operating costs; absorption systems; units of refrigeration; ice making; costs of manufacture; insulation and piping; tests of refrigerating plants.

COPPERSMITHING (in preparation).

MOLDING (in preparation).

Course VII. ELECTRICAL ENGINEERING.

PRACTICAL ELECTRICITY.

This course is the beginning course in electricity. The rudiments are so simply treated that any man can begin this subject without previous study or practical experience in electrical work. The subjects included are: Natural magnets; artificial magnets; magnetism; cause of flow of electric current; ammeters; measurement of voltage; voltmeters; Ohm's law; divided circuits; electric resistance; calculation of electric power; principles of the dynamo; commutators; electric motors; precautions in starting motors; power losses in generators and motors; efficiencies of generators and motors.

ELEMENTARY MAGNETISM AND ELECTRICITY.

This course is designed to meet the needs of students who may have had some practical experience with electrical apparatus or machinery but whose knowledge of the principles of its operation and of mathematics is limited. To make magnetic and electric principles real to such a student, the subject is developed experimentally. The student is expected to perform simple experiments and thus to observe the actual phenomena. Then by questions and discussions he is aided in the interpretation of his observations and the formulation of his conclusions into workable ideas.

Topics treated.—Magnetism; electromagnetism; some practical applications of electromagnets; electromagnetic induction; current electricity; electrolysis; resistance; flow of current in a circuit; electric generator and motor; work and energy.

THEORY AND OPERATION OF DIRECT-CURRENT MACHINERY.

This is an elementary course on direct-current machinery. Only the more elementary principles of mathematics are used. The principles involved are explained so fully that a reader unable to follow the mathematical solution may acquire complete understanding of the subject.

Topics treated.—Fundamental magnetic principles, electromagnetism, electromagnetic induction, units of measurement, transformation of energy, the continuous-current generator and motor, the magnetic circuit of the direct-current dynamo, armatures, uses of electrical energy, types of dynamos, commutation, operating characteristics of generators, operation

and care of generators, operating characteristics of motors, operation of three-wire systems, selection and installation of dynamos.

THEORY OF ALTERNATING CURRENTS. (An advanced course.)

It gives an analytical and graphical treatment for engineers. The subjects treated include: Wave forms, power measurements, transmission circuits, line inductance, alternators, transformers, induction motors, converters. Those taking up this course will find it to their advantage to have had work in trigonometry and dynamo-electric machinery.

Course VIII. GAS ENGINEERING.

GAS AND OIL ENGINES. (Courses I and II.)

This course is divided into two parts of 10 lessons each.

Course I, assignments 1 to 10, takes up thoroughly the mechanism and operation of gas engines. Although this course treats primarily of the gasoline engine, it includes also the study of gas, kerosene, and heavy-fuel engines; four-cycle and two-cycle types; mechanism of the engine; indicator diagrams; valve adjustment; carburetors; weak and strong mixtures; lubrication; spark coils; self-starters; engine fuels, including gasoline, kerosene, alcohol, crude oil, producer gas, "coal" gas, water gas, etc.

Course II, assignments 11 to 20, goes further into the subject and treats of gas producers, including gas manufacture and analysis; heating value of oil and gas fuels; relation of compression to efficiency; heat losses; measurement of power; gas-producer construction and operation; and engine testing.

Course IX. YEOMANRY.

MANUAL OF OFFICE PROCEDURE (in preparation).

The preparation of a new Manual of Office Procedure is under way. Such a manual was prepared by an officer for the Destroyer Squadrons, Atlantic Fleet, and is being used in that force with success. Officers have been assigned by the Navy Department to work out a standard system of office procedure, correspondence, filing, etc., for the purpose of unifying and standardizing office practice throughout the ships and stations of the Navy. It is anticipated that this information can be obtained for incorporation in a manual of lessons which will serve as a guide for men in the special branch of yeomanry.

TYPEWRITING.

Typist's Guide—From Sight to Touch.—Touch typewriting is here briefly set forth in six short lessons. The design of it is to explain touch typewriting to beginners and to guide operators who desire to change from the sight system to the touch system without wasting their time on useless experiments. The lessons are so graded that anyone can get the idea of the touch system. For a more thorough study, the following rational typewriting course is recommended:

Rational Typewriting.—This course offers a more complete and intensive study of typewriting. The method of learning the finger-board technic advocated in this course brings quick and effective results. A mastery of the keyboard is developed by beginning in the central division of the keyboard, working up efficient technic through intensive exercises with the index fingers first. Through this the student is enabled to acquire the natural hand position and an accurate sense of the guide keys from the start. When the proper time comes the exercises carry him on to include the use of all the fingers one at a time until the little fingers are trained to a proficiency equal to that of the index fingers.

This course in Typewriting has been very widely used and was awarded the medal of honor at the Panama Pacific International Exposition. The whole idea of the course is to lead the student from the simple exercise within the range of his practical ability to the more complex but simple graduated steps. For a complete mastery of the typewriting machine this course is recommended.

SHORTHAND.

The ability to write shorthand is a stepping-stone in the yeoman branch. According to a recent ruling, a yeoman to be rated as first class must be able to take dictation at a speed of 60 words per minute, and as chief at a speed of 80 words per minute. This course uses the Gregg system and is offered with a view to the needs of yeoman for the work of the ship's office and for advancement in rating.

ELEMENTARY BOOKKEEPING.

Every undertaking should be checked by a good system of bookkeeping. Skilled workmen may be employed, good materials may be used, but if poor management takes the form of undetected waste, careless or misleading financial statements, the work will sooner or later go bad. If books are accurately

kept, the persons responsible have an accurate gauge to the financial success of their undertakings and methods. It is the record which shows more accurately than any other whether or not a piece of work is successful and is being managed on right lines.

The object of this course is to present in a simple understandable form the fundamental principles used in keeping accurate accounts and to afford practice in applying these principles.

ELEMENTARY ACCOUNTING.

This course is designed to give instruction in the important features of accounting. It may be taken by those who desire a review knowledge of the principles of bookkeeping. However, no previous knowledge of the subject is required as the course begins with the first principles of bookkeeping and accounting. The first assignments present the fundamental principles of double entry in a thorough manner and provide at the same time sufficient drill in the application of these principles to enable one to perform the practical work in bookkeeping and accounting which follows. The course proceeds by easy stages and in a logical manner, and its satisfactory completion should give one a practical knowledge of bookkeeping processes and qualify him to assume the responsibility of bookkeeping.

FIRST LESSONS IN BUSINESS.

It is necessary to understand common business practices and qualifications; business courtesies, promptness, industry, loyalty, budgets, cost accounts and business forms, and investments. These are clearly set forth in these "First Lessons in Business" and are so presented as to be very readable and highly valuable and instructive.

BUSINESS LAW.

This course includes a discussion and study of the business laws with which everyone should be familiar: Contracts; agency; personal property; chattel mortgages; title to real estate; real estate mortgages; landlord and tenant; trusts and trustees; negotiable instruments; partnership; corporations; insurance; bankruptcy.

Course X. COMMISSARY (in preparation).

COOKS AND BAKERS (in preparation).

STEWARDS (in preparation).

Course XI. PHARMACY.

ANATOMY, PHYSIOLOGY, AND FIRST AID.

The Bureau of Navigation offers to the enlisted personnel of the Navy a correspondence course in anatomy, physiology, and first aid, which has been prepared by one of the Hospital Corps training schools of the Navy.

This course embraces elementary instruction in anatomy, which deals with the structure of the human body; physiology, which treats of the function of the various organs of the body; and first aid, which furnishes information regarding emergency treatments for the more common accidents and conditions requiring the administration of first aid.

CHEMISTRY, ORGANIC AND INORGANIC (for pharmacy students).

The Bureau of Navigation offers to the enlisted personnel of the Navy a correspondence course in chemistry, organic and inorganic, which has been prepared by one of the Hospital Corps training schools of the Navy.

This course presents the elementary instruction necessary for preliminary work in chemistry and will serve as a foundation for more advanced work along chemical lines.

It is essential that the prospective student thoroughly familiarize himself with inorganic chemistry before the more advanced work of organic chemistry is undertaken. Candidates for this course are urged to take every advantage of such practical work in chemistry that may be offered them. By combining this practical with the theoretical instruction contained in this course, it is believed that a fairly good knowledge of chemistry may be obtained.

PHARMACY.

The correspondence course of pharmacy which is submitted by the Bureau of Navigation has been prepared by one of the Hospital Corps training schools of the Navy, and, although not embracing the pharmacy required for members of the Hospital Corps, covers the subject of pharmacy in such a manner that a good preliminary knowledge may be obtained from it. Prospective candidates for this course of instruction are urged to familiarize themselves with the course offered in

organic and inorganic chemistry prior to taking this course in pharmacy. Theoretical pharmacy is a somewhat difficult subject to study, but by combining the theory of pharmacy with such practical work as the candidates may have access to, it is believed that a fairly good knowledge of pharmacy may be obtained from this course.

GENERAL SUBJECTS.

SPELLING.

The Navy Speller was compiled by the Bureau of Navigation especially for men in the Navy and has been recently revised to contain latest approved terms in various naval subjects and a revised list of naval ratings. Three thousand words which every sailor should know how to spell are presented in small lesson-sized groups.

Lessons 1–50 contain the Ayres lists of 1,000 most used words in the business world; lessons 51–83 introduce such words in the "Army List of Minimum Essentials in Spelling" as are not included in the Ayres list; lessons 84–107 are a compilation of selected difficult words often misspelled; under lessons 108 to 155 is to be found the special feature of the speller, "The Navy Supplement," where words especially applicable to life aboard ship are classified according to subject.

PENMANSHIP.

The Palmer Method of Business Writing is the course used in this subject. Through a series of self-teaching lessons, rapid, plain, unshaded, muscular movement writing is taught. An easy and legible handwriting is the object sought.

ARITHMETIC.

This course is a comprehensive review, beginning with the most simple arithmetical processes, and is designed for the student who has had no work in arithmetic or who wishes to review it quickly. It takes him by easy steps through every process ordinarily given in the elementary schools in addition to short cuts adapted from business.

ELEMENTARY ALGEBRA.

The instruction in algebra is divided into three courses—A–1, A–2, and A–3.

Courses A–2 and A–3 supplement A–1 and carry the subject by gradual steps into more advanced algebra, giving a thorough review of all algebraic principles. The data for the problems introduced are, in the main, of permanent and general interest.

Efficiency in arithmetic is maintained and increased. In subject matter algebra corresponds fairly closely to arithmetic, but for the solution of many types of problems it possesses advantages unknown to the latter. If the student contemplates engaging in any branch of the naval service in which higher mathematics is used, he will find that a clear understanding of algebra is indispensable to progress.

PLANE GEOMETRY; SOLID GEOMETRY.

Both plane geometry and solid geometry are important subjects, and should be taken by those who expect that their duties will demand mechanical skill or highly technical knowledge. These courses in plane and solid geometry are based on textbooks that have been shortened as much as possible to leave sane and safe minimum courses. The logical order of presenting the geometrical theorems has been preserved, but simple applied problems are brought in to exhibit the practical uses of geometry.

PLANE TRIGONOMETRY.

This is a practical course in trigonometry. All that is not necessary to a clear understanding of the subject has been eliminated and the practical has been put before the theoretical in every new feature set forth. The practical uses of the subject are shown by the many nontechnical applications. A knowledge of this subject is useful to the more advanced work in steam engineering, electrical engineering, surveying, and navigation.

NAVY PRIMER.

This is a primer designed for men who have had little or no school education. It introduces Navy terms, with exercises in spelling, reading, and sentence building showing the correct use of Navy terms.

PLAIN ENGLISH.

This is a thoroughly practical course in elementary English that gives instruction in the rudiments of English speech. A study of grammar is necessary if one is ambitious to express himself intelligently and with precision. A correct use of our mother tongue is important if we would pass on our thoughts and ideas to others. Only the elements of English grammar are here presented, but if these are grasped, it is an easy step to the mastery of a fluent and concise style.

The textbook, dedicated to those who "don't like grammer," is divided into two parts. Part I covers the essential points in

English syntax, including all that pertains to the seven parts of speech and the analysis of sentences. Set rules are omitted. Definitions have been admitted, but sparingly. The sentences for practice in analysis have been carefully chosen. Part II is more general in character, covering a variety of subjects and a large amount of material for practice. The chapters on clearness, force, punctuation, and the list of appropriate prepositions will be found especially valuable. Considerable space has been given to the study of misused words. The general plan of the work is such as to enable a student to get a maximum of benefit with a minimum of labor and time.

ENGLISH FOR ENLISTED MEN.

Prepared by William Oliver Stevens, professor of English, United States Naval Academy. It is especially adapted to the needs of the Navy. The principles of English are illustrated by examples taken from naval history and the required exercises are about things familiar to the average seaman.

Getting ahead in the Navy or in civil life depends on a man's ability to make good. For the most part this means knowing your job and knowing it well enough to win a better one. But to get beyond a certain point a man needs to know things outside of his job—what we call "education." The most important of these things is the ability to speak and write good English. A man may not know plane geometry and get along swimmingly in a thousand occupations, but one who does not know plain English is giving himself away every time he opens his mouth or writes a letter. He is silently put down by other people as uneducated or "illiterate," and therefore unfit for a position that he might otherwise fill. If a man has not had home and school advantages in learning to use his mother tongue properly, he must buckle down to the hard task of trying to make up the deficiency. Otherwise his ambition to get ahead is going to be hobbled from the beginning. It will be like running a race with an iron ball chained to the ankle.

The object of this course in English for enlisted men is to give just such help as is most practical, to break incorrect habits of speech and writing, and to set up correct ones; in short, to remove the handicap that many a man has through no fault of his own. This study of correct English begins with the simplest unit, the word, and by easy steps works its way through to composition and the writing of original articles.

EFFECTIVE ENGLISH AND LETTER WRITING, DRILLS IN.

This course has been developed by the elimination of the nonessential, by the omission of much that is technical, and by emphasizing those things that have a direct bearing on the work of a stenographer, bookkeeper, or office worker. The purpose of this course is to give a thoroughly practical drill in English and to acquaint the student with its application to business forms, customs, and usages.

ELEMENTARY CHEMISTRY. (A general course on the elements of chemistry.)

This course is suited to the needs of those who have not had any previous training in the subject and is designed as a foundation for future work and study. It takes up chemical elements, principles, and laws; characteristic chemical changes; chemical compounds and mixtures; acids, bases, and gases and methods of recording scientific observations, with some of the basic chemical experiments for laboratory study. (See also the special chemistry course prepared for pharmacist's students.)

ELEMENTARY PHYSICS.

Elementary physics is presented in such a way as to stimulate the student to do some thinking on his own account about the hows and the whys of the physical world in which he lives. The consideration of how a thing happens is followed by a discussion of why it happens.

Only such subjects have been included as touch most closely the everyday life of the average person and which will help him to adjust himself to his surroundings and interpret his own experiences correctly. This course keeps pace with our fast-changing modern life and has been recently revised to introduce the many new ideas in the physical world developed by the World War. It will on this account be found especially appropriate and helpful for naval study. Some of the new subjects included are the internal-combustion engine, principles of the airplane, the tank, liberty motor, sound ranging record of the end of war, the details of the submarine, etc.

MECHANICAL DRAWING.

The course in mechanical drawing is designed to give those taking up any kind of engineering training a thorough preparation for their further work. The art of drawing is the language in which mechanical facts are expressed, and is therefore a necessity to engineers.

The first division of the subject treats of the use and care of instruments and has chapters on free-hand lettering, straight-

line work, use of the compass, inking with the ruling pen, and geometrical drawing. The time spent on this branch saves time later in executing work. The student is now able to take a position as draftsman on tracing work.

The second division treats of the science of orthographic projection. This is the geometrical basis of all kinds of industrial drawing. It is treated in a way which shows at each step the practical value of the science, while keeping the attention on the principles. It has chapters on lines and planes, cylinders and cones, intersections, developments and sheet-metal work, screw surface and isometric drawing.

The third division treats of machine drawing. The chapters show how to sketch small machine parts, how to select views and sections, what dimensions to record, how to draw standard bolts, nuts, pipe fittings, valves, and, finally, how to combine parts in making assembled drawings.

The fourth division treats of the elements of detail designing. It covers the making of drawings of the parts from assembled mechanisms, supplying the details there omitted, using as far as possible tables of standards, showing "finish" and making "tolerances" for permitting motion. It teaches also the detailing of plate-metal work and riveted structures. The student who has completely covered this final section is in position to be trusted with real drafting, not merely tracing.

AMERICAN HISTORY (a brief survey).

This course is offered in the form of a small pamphlet, entitled "The Little Book of Our Country." It gives a short, simple, rapid, and connected account of our country's story from its discovery to the present day. As far as the limits of the pamphlet will permit, "the whys" of our history are gone into, and it is believed that there can be gained from this booklet a definite knowledge of the large events in the history of our land, some idea of the causes of those events, and a sympathetic insight into the growth and development of our Nation and of the people who stood behind it.

ELEMENTARY UNITED STATES HISTORY AND GOVERNMENT.

History helps the student to understand the struggles of nations, the feelings and desires that prompted men to action, and the difficulties that had to be overcome in order to attain our present civilization; but most of all it helps him to find methods for the solution of present-day problems. The study of history is helpful training for administrative duties, for citizenship, for public life, and especially for the decision of any question which needs a knowledge of the past for its settlement.

This course includes the "Leading Facts" in the history of our country, and groups the discussion around such important single movements as territorial expansion, foreign relations, origin and growth of political parties, our industrial progress, etc. The purpose of this course is: First, to offer a history course to those who wish to refresh their knowledge of United States history; second, to offer supplementary material to those who wish to add to their grasp of American history; third, to present a larger view of American life, past and present, which will stimulate greater interest in modern social and political conditions because of the better understanding of their causes.

CIVICS.

The one study that should be pursued more than any other in America is the study of how we can best cooperate to make democracy as effective as possible. As has been said, the ills that confront a democracy have their solution all to be found in the democracy itself. The study of civics should give the student an intelligent understanding of the machinery of government and should encourage him to assume his responsibility in whatever work he is engaged and to confront his problems with justice and wisdom. This course presents in an elementary way the actual workings of government by beginning with the immediate life of the ship community and shows that when men have common purposes and are dependent upon one another in accomplishing them there must be cooperation, which is another name for "team work." The principle of "pulling together," "team work," or "cooperation" is of the greatest importance in everyday life or national life, and is stressed throughout the course. This course aims to teach men their civic responsibilities, as well as their civic opportunities, because men so trained will learn to respect first the rights of their neighbors, and will then be as fair in their dealings with their Government as with their fellow men. Civics is very closely connected with the study of history, and should be studied in connection with history.

SPANISH.

The study of Spanish is not only interesting but eminently practical, in view of the recent commercial development in the Spanish-speaking countries of the Americas. The first course in Spanish aims to give constant drill in grammatical rules and principles and to serve as a foundation for the next course—advanced and commercial Spanish—in which the special feature is the writing of business letters in that language.

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